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(54) **Mixing device**

(57) A mixing device, especially intended for use in an animal feeding device, has an auger (14) which draws down particulate food within a supply tube (16) from a hopper (10), whilst liquid is delivered to a point (36) adjacent a bottom outlet of the supply tube, from which the food and liquid is directly supplied into a feeding trough.

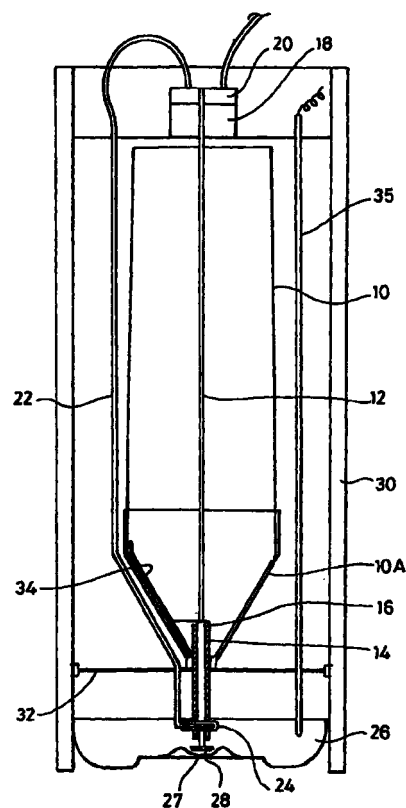


Fig. 1

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## Description

[0001] This invention relates to a mixing device and also to an animal feeding device incorporating the mixing device. The animal feeding device is especially suited to the feeding of young livestock and poultry, for example young pigs immediately after weaning.

[0002] According to the invention, there is provided an animal feeding device comprising a hopper for dry animal feed material, an auger for drawing said material from the hopper in an at least partially downward direction within a supply tube having a bottom outlet, means for driving the auger, means for injecting liquid to be mixed with the dry feed material at a point below the junction of the hopper and the supply tube, and a feeding trough into which the animal feed material and liquid is directly delivered, either mixed or separately.

[0003] Young pigs, immediately after weaning, find it difficult to accept dry food. Such young pigs find it easier to adapt from a sow's milk to a moist food, such as that provided by the animal feeding device of this invention. Tests have shown that, especially in the first week after weaning, use of the feeding device of the present invention enables weight gain of two to three times that achieved by normal dry food feeding methods and an accompanying separate liquid supply.

[0004] The invention is further described with reference to the accompanying drawings, in which:-

Figure 1 shows one embodiment of animal feeding device in accordance with the invention;

Figure 2 shows a modified embodiment; and

Figure 3 shows in more detail a preferred arrangement of the mixing well and parts adjacent thereto.

[0005] Referring to Figure 1, a circular hopper 10 with a vertical axis and a bottom end funnel 10A has extending downwardly through it an on axis auger shaft 12 leading to an auger 14 housed within a supply tube 16 extending through the opening of the funnel.

[0006] The auger 14 is drivable by an electric motor 18 which is mechanically linked to a peristaltic pump 20 also to be driven by the motor. From the pump 20, a feed pipe 22 extends down to a point of the supply tube 16 just above an outlet at its bottom funnel end, to deliver a liquid such as water to the interior of the supply tube through one or more openings in the wall thereof. The connection between the feed pipe 22 and the supply tube is enabled by a clamping ring 24.

[0007] In use, the auger draws down dry particulate animal food, more especially pig food, from the hopper. At the liquid injection point, liquid for moistening the feed is fed in as the auger continues to draw down the food to the outlet at the bottom of the supply tube. The amount of liquid fed in may be metered by a solenoid valve.

[0008] The animal food, together with the liquid, is

delivered into a circular feeding trough 26 which, immediately below the bottom outlet of the supply tube 16, is formed with a well 27 within which rotates a paddle or analogous mixing element 28 driven from the bottom end of the auger. The paddle 28 in use ensures complete mixing of the dry food and liquid, before the now moist food spills out of the well 27 into the main part of the feeding trough 26.

[0009] Suspended from a hopper supporting frame 30 is a circular hoop 32, lying in a horizontal plane at an appropriate level above the rim of the feeding trough 26, such that in order to gain access to the feeding trough, an animal such as a young pig has to nudge the hoop upwardly, thereby to activate a switching means (not shown) which starts the auger driving motor 18 into operation. The circular hoop may be replaced by any other convenient form of animal operable nudge bar or the like.

[0010] Also shown in Figure 1 is a stirrer blade 34, in use driven in rotation by the auger 14, and serving to prevent bridging and coagulation of the dry food within the tunnel at the bottom of the hopper.

[0011] A level sensing probe 35 acts to prevent the moist food rising above a predetermined level in the trough 26. Moreover, a timer (not shown) may be incorporated which periodically signals the pigs to feed.

[0012] The timer may be used in combination with the animal operable switching means or, in some circumstances, may be used in place thereof, the noise of the motor and auger starting up providing an audible signal to the pigs.

[0013] Partial or total control by a timer can also enable the feeder to dose food according to a feed plan specifically suited to the age, development state and number of pigs to be fed. For example, the timer may switch on the feeder and signal the pigs for feeding at hourly intervals, the feeder remaining operative for a period appropriate for mixing the correct dosage of food for the number of pigs to be fed, dependent on their age and development state. At or after the end of this period, when the feeder is switched off, the pigs will have eaten all the food in the trough, so that the trough is left empty ready to receive the next hourly dosage and stale food is not allowed to ferment or become rancid, as the pigs will not eat stale food.

[0014] In this connection, it is important in the case of some foods and liquids that liquid enters the supply tube close to its bottom outlet, because the pigs demand freshly mixed food and, for example, may be liable to reject food which has been prior mixed during transport though the supply tube by the auger. However, injection of the liquid into the supply tube at any point in advance of the bottom outlet is not excluded, as in some cases this may be perfectly acceptable, and enable mixing to take place during transport though the supply tube, possibly making unnecessary the provision of a mixing well in the feeding trough.

[0015] It can also be arranged that, if all the pigs

leave the feeding trough, releasing the animal operable switching means, the motor drive to the auger is immediately switched off. Further, it can be arranged by use of animal operable switching means that, within a predetermined time limit, the timer is temporarily over-ridden to cause a small amount of food to be mixed and delivered if an animal calls for more food between the set intervals.

**[0016]** Figure 2, employing the same reference numerals as Figure 1 for similar parts, shows a modified embodiment in which the liquid is delivered to the injection point through the interior of the auger shaft 12 and auger 14, the wall of the auger being apertured, as indicated at 36, to deliver the liquid to the inside of the supply tube 16 close to the bottom end thereof.

**[0017]** In other respects, the embodiment of Figure 2 is similar to that of Figure 1.

**[0018]** Figure 3 shows in more detail the preferred arrangement of the mixing well 27 and parts adjacent thereto. Especially to be noted is a cover 40 for the mixing well 27, carried by the bottom end of the supply tube 16. The cover constitutes a shield preventing animal access to the mixing well 27.

**[0019]** The transmission from the auger 14 to the mixing element 28 comprises a triangularly shaped bottom end 14A to the auger, into which engages a triangularly shaped stub shaft 42 upstanding from the mixing element.

**[0020]** The top of the peripheral wall of the mixing well 27, over which moist food spills into the feeding trough 26, is smoothly curved over, down and outwards to form the base of the feeding trough.

**[0021]** It can also be more clearly seen that, in this preferred arrangement, the liquid injection point 44 is very close to the bottom end of the supply tube 16, so that the auger 14 plays substantially no part in the mixing of the dry animal feed and the liquid.

## Claims

1. An animal feeding device comprising a hopper for dry animal feed material, an auger for drawing said material from the hopper in an at least partially downward direction within a supply tube having a bottom outlet, means for driving the auger, means for injecting liquid to be mixed with the dry feed material, at a point below the junction of the hopper and the supply tube, and a feeding trough into which the animal feed material and liquid is directly delivered, either mixed or separately.
2. A device according to claim 1, wherein the injection point is closely adjacent the bottom outlet of the supply tube.
3. A device according to claim 1 or claim 2, wherein a mixing element is provided at the outlet end of the supply tube, drivable by the auger to mix the dry material and the liquid.
4. A device according to claim 3, wherein the mixing element is located in a welled area of the feeding trough.
5. A device according to any of claims 1 to 4, including a liquid pump for pumping liquid to the injection point, the pump being driven by the auger or its driving means.
6. A device according to any of claims 1 to 5, wherein the liquid is fed down the inside of an auger drive shaft to the injection point, or the liquid is piped to the injection point and injected through the wall of the supply tube.
7. A device according to any of claims 1 to 6, including a timer for at least in part controlling operation of the auger driving means.
8. A device according to any of claims 1 to 7, having an animal operable switch means for at least in part controlling operation of the auger driving means, the switch means comprising a member positioned to be automatically operated by an animal seeking access to the feed trough.
9. A device according to any of claims 1 to 8, wherein the auger carries a stirrer which in use rotates within the hopper as the auger rotates.
10. A device according to any of claims 1 to 9, including a level sensor for switching off the auger driving means when the moist food in the feeding trough reaches a predetermined level.

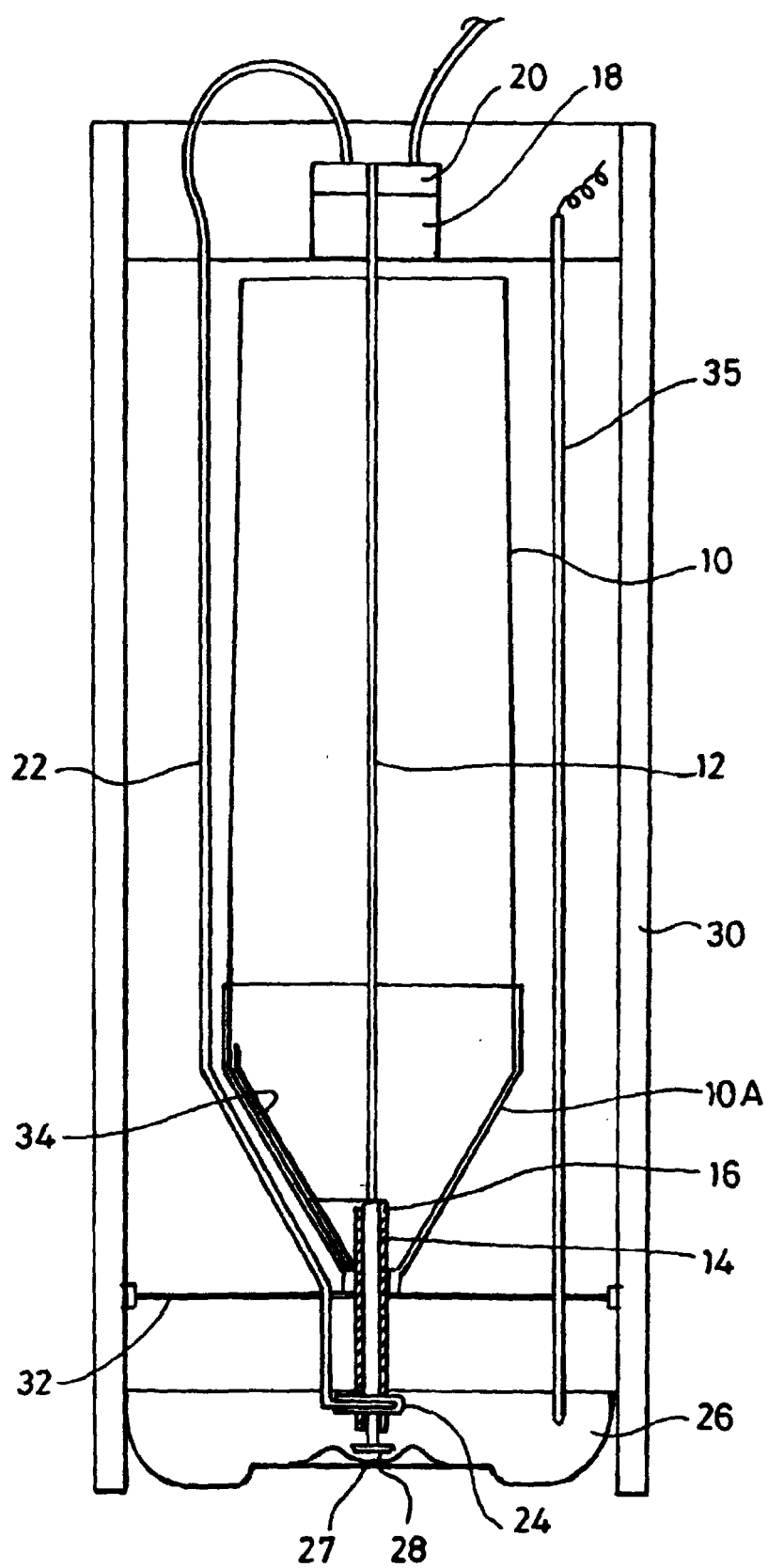
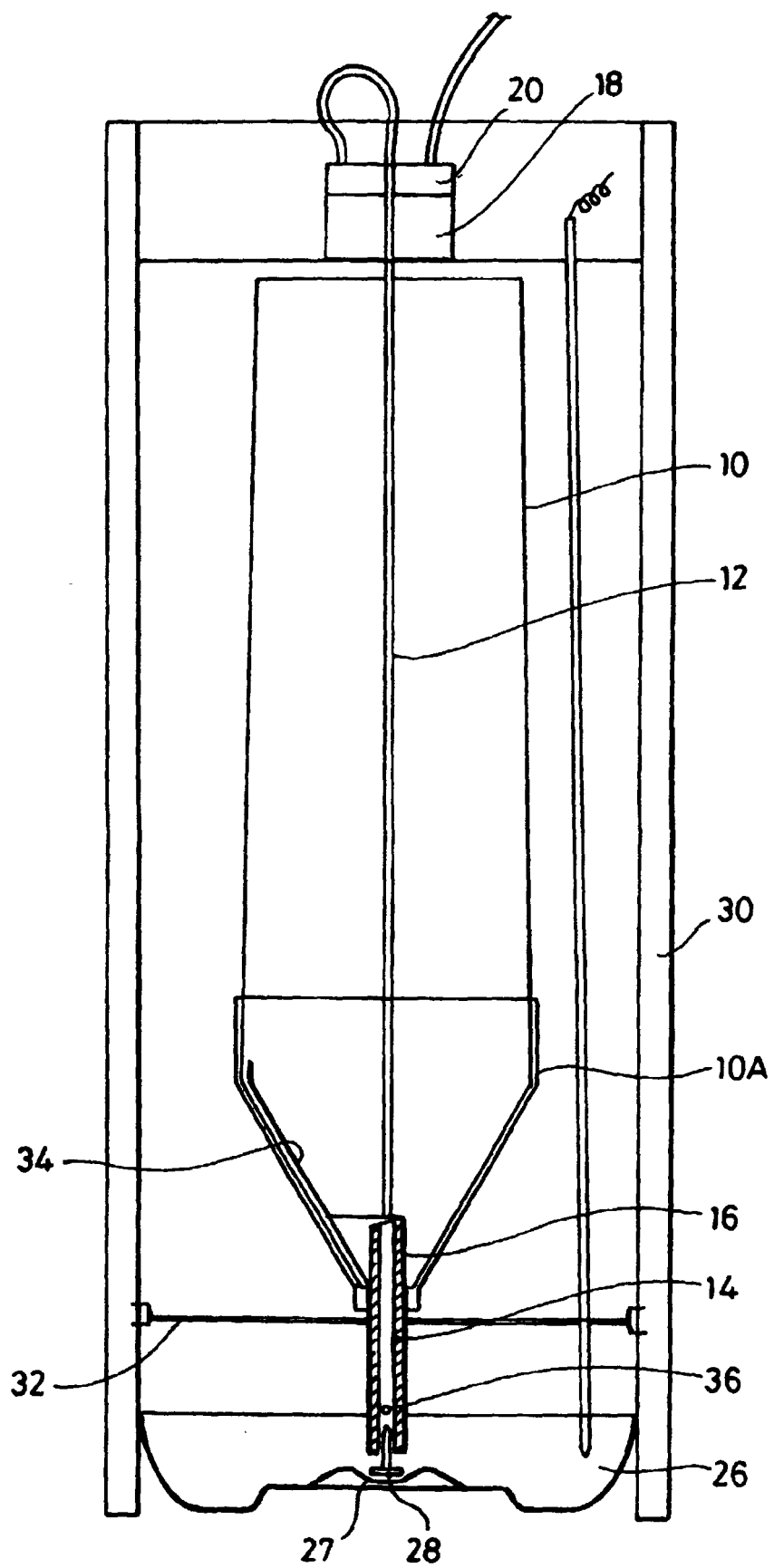
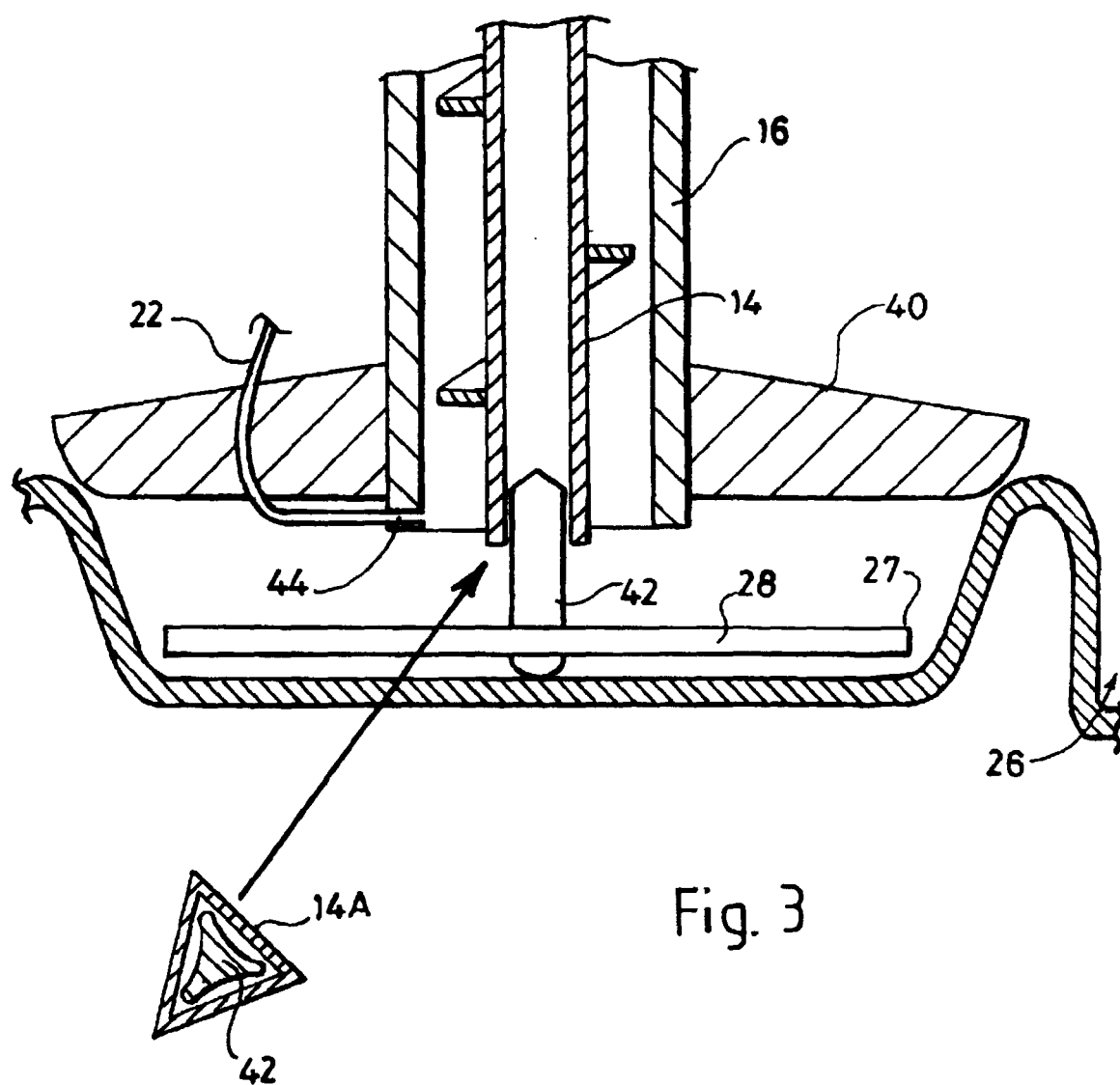


Fig. 1







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Application Number  
EP 99 30 8509

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			TECHNICAL FIELDS SEARCHED (Int.CI.7)
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The present search report has been drawn up for all claims			
Place of search <b>MUNICH</b>		Date of completion of the search <b>21 January 2000</b>	Examiner <b>Weber, G</b>
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P4/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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